Notes on an Engineering Forum
Roundtable Discussion on Thermal Desorption

U.S. EPA Technical Support Project Meeting
R.S. Kerr Laboratory
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ROUNDTABLE DISCUSSION ON THERMAL DESORPTION

INTRODUCTION

Steve Kinser, Engineering Forum Co-Chair and moderator for the Roundtable discussion, described the purpose for the Roundtable: to discuss contracting, design, and remediation aspects of thermal desorption technology and to develop notes from the discussion for use by EPA project managers who are considering the use of thermal desorption as a treatment technology to help them avoid problems associated with thermal desorption. The panelists for this discussion were:

Mike Cosmos, Weston
Bill Crawford, USACE-Omaha
John Sedwick, Southwest Soil Remediation
Chetan Trivedi, OHM Remediation Serv. Corp.
Bill Troxler, Focus Environmental
Steve Warren, Maxymillian Technologies

This Roundtable discussion was the second in a series of Roundtable discussions. The first was held on Permeable Reactive Walls in January 1997.

CONTRACTING ISSUES

The Forum asked panelists whether the type of EPA contract (*i.e.*, cost-plus or fixed price) affects the selection of a technology or the time it takes a contractor to respond to a Request for Proposal (RFP). One panelist noted that most contractors prefer a cost-plus contract because it has less financial risk attached to it than a lump-sum contract. Another panelist noted that Potentially Responsible Parties (PRPs) sometimes try to save money by doing less site characterization, which often results in increased remediation costs due to the added risk a contractor assumes when working on such a site.

It was noted that thermal desorption projects often are "costed out" by the unit (by the ton or by cubic yards), which can provide a more straightforward cost estimate than other technologies. However, there was some disagreement on this because accurate estimates of waste soil quantities at a site depend on the quality of the site's waste characterization. For this reason, one panelist said that he structures contracts with a combination of methods: lump-sum pricing for things that are well defined and within a contractor's primary control, such as mobilization, erection, demobilization, and decontamination; and unit pricing for unknowns, such as soil quantities.

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[1]Co-Chair, Engineering Forum

All panelists agreed that riskier projects will cost more money. Cost-plus contracts are preferred because they enable a contractor to better deal with unknowns found in the field and enable partnering between the contractor and the PRP or Army Corps of Engineers. In addition, they cost less money because contractor costs do not include the added cost for risk. It was noted, however, that lump-sum contracts are easier to administer.

In response to a concern that cost-plus contracts may cost EPA more money, the panelists noted that cost-plus projects that include upfront and well-defined waste and feed characterizations should not result in any additional costs. In response to a question on meeting performance standards, the panelists noted that they bid on contracts that only include one pass-through of the contaminated soil through their system. Estimates that assume more than one pass-through demonstrate failure in either the contractor's system or the selection of the preferred remediation technology.

SYSTEM DESIGN

In response to the Forum's question about system design, the panelists noted that RFPs should include the following information:

- Moisture content of the soil to be remediated
- Soil characteristics [*i.e.*, clay, fatty clay (moist, slimy clay) and sand]
- All chemical contamination, not just the contaminants of concern
- Depth of the contamination
- Statistical sampling results for layered soils
- Geophysical characteristics
- Plasticity data for soils
- Hydrocarbon data
- Permitting requirements

A Forum member asked what parameters a contractor would like to see for a site contaminated with a suite of pesticides in Mississippi alluvial soils. One panelist noted that the most important characteristics to know would be moisture content of the soil, the specific pesticides applied at the site, the type of clay, whether there is any petroleum or trace metals contamination, and the geophysical characteristics. The panelists noted that Mississippi clay material can be very sticky and difficult to pre-process.

In response to another question about what physical characteristic information is needed from a site, the panelists said that it is very site-specific. For example, for some areas, one sample can provide adequate physical characteristic information, but for others, especially multiple layered soils, more samples are needed to obtain a better vertical profile of the area. Detailed information in the Remedial Investigation/Feasibility Study (RI/FS) will help the contractor figure out how to best process the material. Physical characteristic information should be detailed enough to enable the contractor to assess what it will take to treat the material and how to optimize the excavation.

One Forum member asked the panelists if RFPs call for enough pilot testing and, if so, do these pilots provide the answers needed to optimize the design of the equipment to be used at the site. He noted that skipping the pilot test can be detrimental to a project. A panelist said that RFPs often do not include permitting requirements, such as the category of incinerator, *e.g.*, Subpart O Incinerators, and whether it is required to have an indirect "fired" unit. A lot of this information is vague and has to be researched by the contractor prior to bidding. Often times the contractor has to contact the state, which is not aware of the requirements either. Therefore, the contractor has to make "guesstimates" before the project even starts.

Subpart O requires trial burns to prove a unit can meet the specifications prior to implementation of a full-blown remediation. Pilot- and bench-scale testing is primarily done during the remedial design phase, and is seldom conducted after a contractor bids a project. Pilots are very expensive and often do not provide added value to a contractor. One panelist said that EPA should choose contractors with proven technologies on projects that have established cleanup timeframes instead of conducting perfunctory pilots to prove what they already know. Another panelist noted that different machines operate differently, but that one can take a benchscale test for one piece of equipment and relate it to their own equipment to find out how their equipment would perform instead of conducting a pilot.

A Forum member noted that benchscale tests are not always conducted with the proper process parameters or measurements in mind, which creates problems during the design phase. In response, a panelist said that pilot tests are not very helpful unless they are conducted on each machine side-by-side. Another Forum member noted that bench-scale tests can help determine if a particular system can or cannot remediate a site. A panelist said that pilots for a particular technology can be helpful at sites where the technology has not proven to be effective, but that once the technology is proven, pilots are not necessary. It was noted that regulators do not like surprises and would prefer to know if a technology will be effective upfront. In response, a panelist noted that a feasibility study should set the stage for determining whether a particular technology can meet the cleanup standards. A Forum member noted that most feasibility studies do not include multiple pilot studies. A panelist said that the quality of a site characterization can drive the decision to conduct a treatability study. If a site has similar characteristics to another one cleaned up successfully by a particular technology, then a treatability study probably is not needed. In addition, if there is enough data in the literature to support a decision, a treatability study probably is not necessary. In response to a question from the Forum, the panelists said that the thermal desorption vendors have backed off of bidding blindly on projects that do not provide enough site information.

When asked whether there are any compounds that would be inappropriate for treatment by thermal desorption, the panelists identified explosives. In response to another question on how contractors deal with debris, oversized boulders, and buried drums on a site, a panelist noted that he always anticipates a certain quantity of these at any site and that cost estimates address this issue on a line-item basis.

In response to a question on how contractors deal with design issues that have been influenced by a non-technical Remedial Project Manager (RPM), the panelists noted that EPA has contractors who can help RPMs understand the technical issues in a design.

One panelist noted that it would be helpful to know the performance-based emissions standards required for a site. He added that there appear to be no performance-based emissions standards for thermal desorbers.

In response to a question on how contractors deal with RFPs that are missing information needed to make a proper bid, the panelists agreed that it would be helpful if draft RFPs were sent to contractors for review and comment so that missing links could be added before the final RFP goes out for a bid. The Forum noted that extensive comments could result in a 1-3 month delay in issuing the final RFP. The panelists acknowledged this, but agreed that such delays could help avoid big problems in the field later. In addition, they noted that the RFP issuer has the final say on what gets included in the RFP. The bottom line is the contractors will develop ways to meet whatever standards get included in the RFP.

OPERATIONS

Site-specific activities that pose problems with equipment

One Forum member asked where contractors find process "bottlenecks" with thermal desorption equipment. He noted that Region 10 has had problems with conveyor and drag chain systems, and wanted to know whether some equipment operates better than others, and whether some equipment is more prone to break-down. One panelist noted that problems with both thermal desorbers and incinerators can occur during transport of materials from the excavation stockpile to the system, not during treatment within the system. Separation of debris from clay can be problematic and may require different machinery depending on the characteristics of the site.

In response to a question about how to handle ash, it was noted by the panel that it is important to remoisturize ash periodically to keep dust down, that different soil characteristics can make ash a bigger problem at some sites, and more intensive dust handling equipment may be needed at sites with clay soil. One Forum member asked whether ash issues can be handled upfront in the RFP. The Panel said yes, noting that this would help to determine the "shakedown" period—the period when a contractor works with the site soils before conducting the first trial run..

The Forum asked whether contractors include redundancies in their remediation designs to reduce downtime due to broken-down equipment on a site, noting that breakdowns affect both equipment performance and public perception of a particular technology as well. One panelist said that his company does not use total equipment redundancy; instead, it stores spare parts on site and shuts down the equipment for one shift every seven days for preventative maintenance. He added that the company also inspects each unit before it is transported to the site. He said that EPA should examine a contractor's record of performance with a particular piece of equipment before accepting a bid.

One Forum member asked how different contracting mechanisms deal with redundancy. For example, while a lump-sum contract can include redundancy in the fixed price, a cost-plus contract may result in the client being charged for equipment change-outs without the contractor proving that the equipment being used at the site is reliable. A panelist noted that equipment change-out charges can be addressed upfront in a cost-plus contract. It was then noted by the Forum that a requirement of high equipment reliability seems to force contractors to maintain redundant equipment on-site. A panelist noted that materials handling equipment often is too large and bulky to store on site, so it is better to store spare parts instead. In response to a Forum member's comment that some sites are large enough to store redundant equipment, the panelist said that while it may appear there is enough space to store redundant equipment, there are mechanical limitations that preclude storage of some pieces of equipment next to others. In response to a Forum suggestion that a contractor consider operating two units at 60% capacity as compared to one at 100%, a panelist said that this does not address the space limitation issue. Also, running two units at 60% capacity will cost more money, something a contractor cannot afford to include in a bid. In addition, many contractors do not have access to two units that can run simultaneously.

In response to a question about whether the government should require contractors to store redundant emission monitors on site to avoid the need for equipment downtime during monitor calibration, one panelist said that this is not necessary because some emissions monitors run continuously for weeks without needing to be recalibrated. In addition, there are ways to check the monitor without taking it off line for calibration. It was then noted that some regulations require redundancy if the time needed to calibrate the equipment exceeds a certain time limit. This most likely will happen when the equipment malfunctions, not when it needs to be recalibrated. It was then noted that continuous emissions monitoring is not always applicable and that emissions monitoring parameters for thermal desorbers vary; for example,

some require measurements for dissolved oxygen and carbon monoxide, while others require monitoring only for hydrocarbons or acetone.

Controlling Fugitive Emissions/Side Streams

In response to a Forum question, one Panelist noted that fugitive emissions and negative draft are almost always indicative of problems in the uniformity of the feed process; however, as long as BTU values remain constant, the operators can adapt the process to alleviate the problems.

In response to a Forum question on which fugitive emissions control mechanisms are better than others, a panelist noted that fugitive emissions are rarely a problem with thermal desorbers. Another panelist said that fugitive emissions from materials handling equipment are more of a problem than fugitive emissions from the stack. In response to another Forum question on whether EPA should specify stockpiling and screening operations at sites where fugitive emissions may pose problems or specify whether foam suppressants or water should be used to keep emissions down, the Panel noted that such decisions should be made site-specifically. One Panelist suggested that EPA develop a performance-based standard for ambient air monitoring criteria rather than developing an emissions solution upfront; thereby allowing the contractor to decide how to meet the standard. One Forum member said that the issue of fugitive emissions is very sensitive and can cause public concern. A panelist noted that the public generally fears "noticeable" emissions, such as those that create odors or dust; they do not care about emissions at the milligrams per cubic meter level. One Forum member disagreed, noting that some communities have citizen's groups that track emissions very closely.

In response to a Forum question on criteria for "no visible dust," one panelist said that dust is not considered visible unless it is in the form of a "big dust cloud." Another panelist noted that visible dust criteria can pose problems in the excavation area and added that water is the best dust suppressor to use. Another panelist noted that foams and biosuppressants can be used at certain sites as well. In addition, dust problems are less of an issue at smaller sites, especially those that are far from residential communities.

One panelist noted that a high percentage of carry-over material often is contaminated. This may cause a contractor to not meet the performance standards at the backend of the process. If this is the case, it would be better to treat to a higher standard by raising the temperature of the thermal desorber. He added that contractors should have flexibility in the process to meet a particular performance standard. Another panelist noted that requiring segregation of "hot dust" from a system builds in a huge expense and results in a huge potential for increased fugitive dust emissions. It was then noted that systems that create a lot of water and discharge without treatment should be held to a higher treatment standard. Another panelist noted that the impacts of a process, not the separate pieces of a process, should be examined for impacts to human health and the environment. If the process as a whole produces negative impacts, then it should be regulated. It was then added that regulating parts of the process, rather than the process as a whole, slows down the operation and has no bearing on the end result. To get past this, the contractor and the regulator should team together at the beginning of the operation to discuss how the plant is operated and why certain pieces of the process need to be regulated.

One Panelist noted that under RCRA, side streams are not defined as RCRA hazardous waste until they are ready for disposal; however, many are never disposed of by themselves, so they do not fall into this waste category. Another panelist agreed, noting that side streams are not environmental waste streams at all; rather they are "process" streams, which should be treated differently under the regulations. One Forum member noted that the side stream issue at a site in Region 3 is a problem because RCRA specifically states that you cannot mix a RCRA hazardous waste to dilute it to a non-hazardous waste level. One

panelist noted that the stream is not considered a hazardous waste because it is not separately slated for disposal.

It was agreed that the issues of fugitive emissions and side streams warranted further discussion by the regulators at a later date and that contractors would like for to issue some Region-wide consistent rules for equipment.

Sampling During Operation

A panelist noted that sampling is supposed to help contractors understand the processes at work at a site. He added that the turnaround time for analyzing samples can pose fugitive emissions problems because the sample pile often sits out open on the site for extended periods of time. Another panelist noted that the laboratories used to analyze samples should be required to alter their schedules to turn samples around in the time specified by the contract. This would help contractors maintain schedules, and control sampling costs.

MATERIALS HANDLING

Excavation

In response to a Forum question about experiences with excavation, one panelist noted that aside from human health and safety issues, the biggest excavation issues deal with general civil construction work: how deep is the excavation; how will the sides be supported; how will the water in the ground be managed; and how was the system set up. He then noted that it gets complicated when one has various waste streams or tar emulsions that need to be excavated. In addition, surprises, such as buried drums, also can cause problems.

In response to a question about dewatering, a panelist noted that dewatering is a very site-specific issue. Some sites require NPDES permits for the dewatering, others do not. Rainfall runoff is another issue that causes problems and needs to be addressed.

The Forum then asked what kinds of additives are mixed with soil prior to treatment. The panel said that additives can include CKD, lime, basalt, or sand.

One panelist noted that it would be helpful if RFPs included information about how to manage water at a site. Another panelist said that he has seen circumstances where contractors have been given options for treating the water: 1) treat the water, recycle it, and use it to cool the treated soil; 2) collect the water, treat it through carbon, and apply it to soil to be excavated and treated; or 3) dispose of water in a clean area when there is nothing left to put it on, making sure it meets state water standards or complies with a NPDES discharge permit.

One panelist said that he would prefer the Agency to set goals for sites (*i.e.*, to ensure that water is managed properly; or to not have volatiles move off site) rather than set the method for materials handling. This would give contractors flexibility in the materials handling process to meet these goals. Another panelist noted that as soon as intrusive work (*i.e.*, excavation of soils) begins, aggressive monitoring begins and is only decreased when it is proven to be unnecessary.

In response to a Forum question about confirmatory sampling, one panelist noted confirmatory sampling can be expensive. As an alternative, screening methods should be used whenever possible. Another panelist noted that he has sampled in random grids as well.

Debris

In response to a Forum question on how the panelists treat debris, the panelists noted that debris does not sample well. One panelist said that, when possible, it is better to treat debris by crushing or shredding it and sending it through the thermal desorber than it is to dispose of it off site. Another panelist noted that debris handling is primarily "drum handling," which needs to be addressed very carefully. He added that often times, drums and other debris end up being collected and sent off site to a different facility for treatment and disposal.

In response to a question on the size that debris needs to be reduced to in order to go through a thermal desorber, it was noted that it depends on the equipment being used, what the equipment's clearance height is, and whether the material will break up while inside the equipment. Most equipment can handle debris up to two-and-a-half inches in diameter, but some equipment can handle much larger pieces.

In response to a question on what happens to oversized materials that will not fit into a desorber, the panelists said oversize materials get treated and washed, or crushed, broken, and sent through the thermal desorber. It was then noted that the process for handling debris should remain optional; contractors may have different processes for handling debris that are equally as effective but cheaper than others.

Implications of Listed Wastes

In response to a question from the Forum on experiences dealing with listed wastes, one panelist noted that carbon can be dealt with easily except when PCBs are involved; methods for water disposal depend on the disposal requirements (contractors prefer recycling water on-site when possible); and organics can be condensed. A Forum member noted that getting wastes delisted has become easier over the years since EPA's Regional Administrators were given the authority to delist wastes.

SYSTEMS MONITORING

One panelist said he sees regulators applying incinerator monitoring regulations to thermal desorbers, which does not makes sense since incinerators and thermal desorbers use heat to accomplish different things and temperature is not an indicator to determine whether a thermal desorber is working or not. One panelist said that he has seen RODs that set operating standards for thermal desorbers, which are not necessary. He noted that EPA should set performance standards instead and let the equipment operator decide how best to meet the standards. One Forum member questioned whether such a process would give EPA confidence that a particular system is working. Another panelist said that contractors need to know the permit conditions required at a site prior to the first demonstration burn.

One panelist said that bench-test data collected during a Feasibility Study most likely will not provide a representative sample for the site. For example, the sample may not indicate that clays, which require higher treatment temperatures, are located on a site. It was then noted that there are trade-offs between performance and the limitations of the process. He then said that EPA should not limit temperatures for thermal desorbers; this may limit the performance of a system.

A Forum member noted that, as a regulator, he does not want to cross the line between physical separation and thermal desorption and therefore is wary of not requiring a maximum temperature. A panelist noted that soils contaminated with TCE or benzene can easily be cleaned without thermal destruction at low temperatures and sufficient residence time. However, soils contaminated with PCBs may not. Another Forum member asked whether there is a particular temperature that separates thermal desorption from incineration. A panelist noted that he thought 1000°F was the upper limit for thermal desorbers. Another

panelist said that this has been put in EPA guidance, but that some thermal desorbers operate at higher temperatures. However, a system that operates at 1000°F or below with limited oxygen and air flow operates more as a thermal desorber.

One panelist noted that he recently worked on a system that required 95% removal of organics in the air pollution control train and had to check the emissions system every four days through stack sampling. He said he thought that such a requirement was redundant, since the system had a continuous emission monitor on the backend.

In response to a Forum question about the best "real-time" monitoring system for VOCs and particulate matter in the perimeter, the panelist agreed that the Fourier Transformer Infra-Red (FTIR) system is the best if you know the set of contaminants you are dealing with upfront. It uses a light pattern and laser, and can be tied into an alarm system. As far as near-time systems, portable GCs work well.

WRAP-UP

In closing, one panelist offered that early involvement and discussion of the issues help the remediation process run more smoothly.